

BULLETIN No. 188

ISSUE I

AUGUST, 1945

TELETYPE

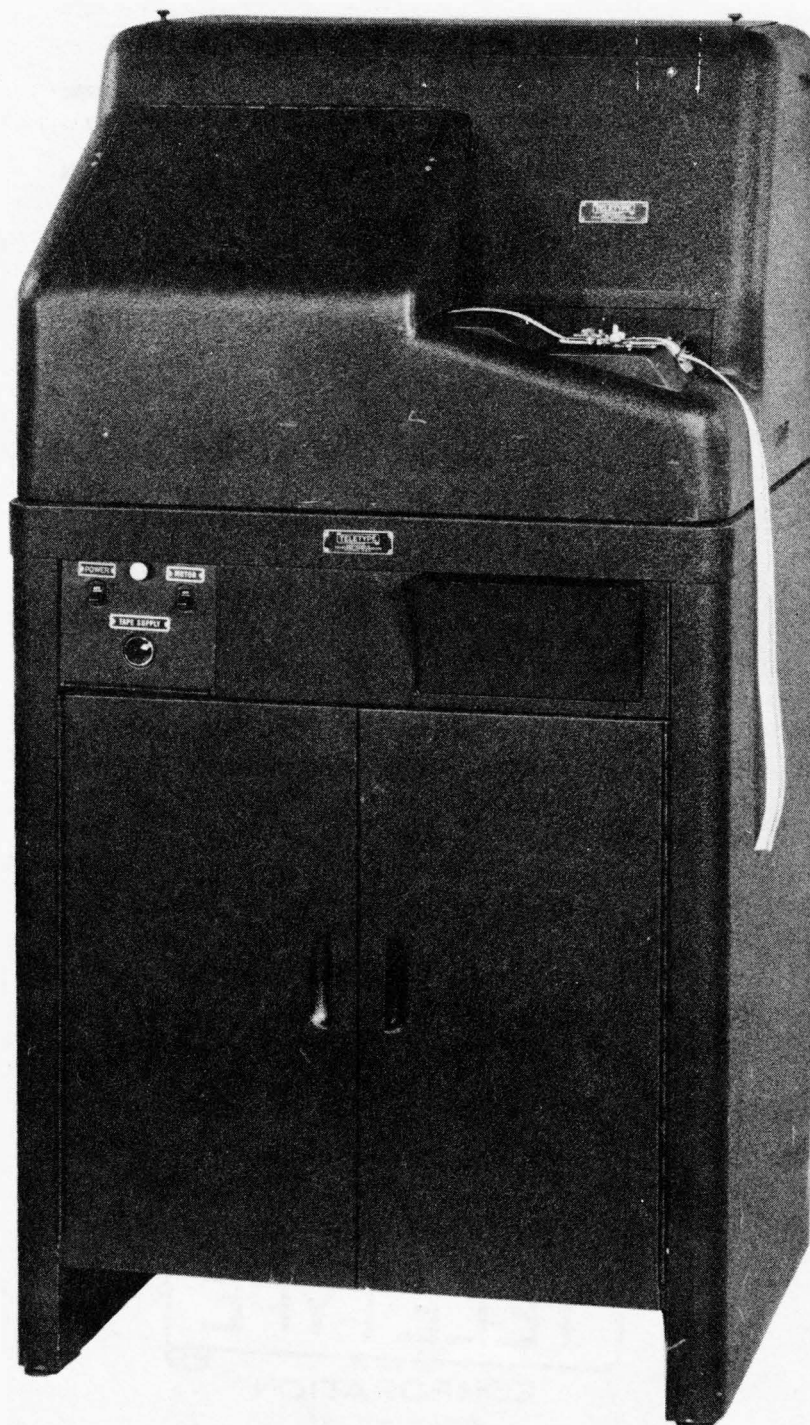
PRINTING TELEGRAPH SYSTEMS

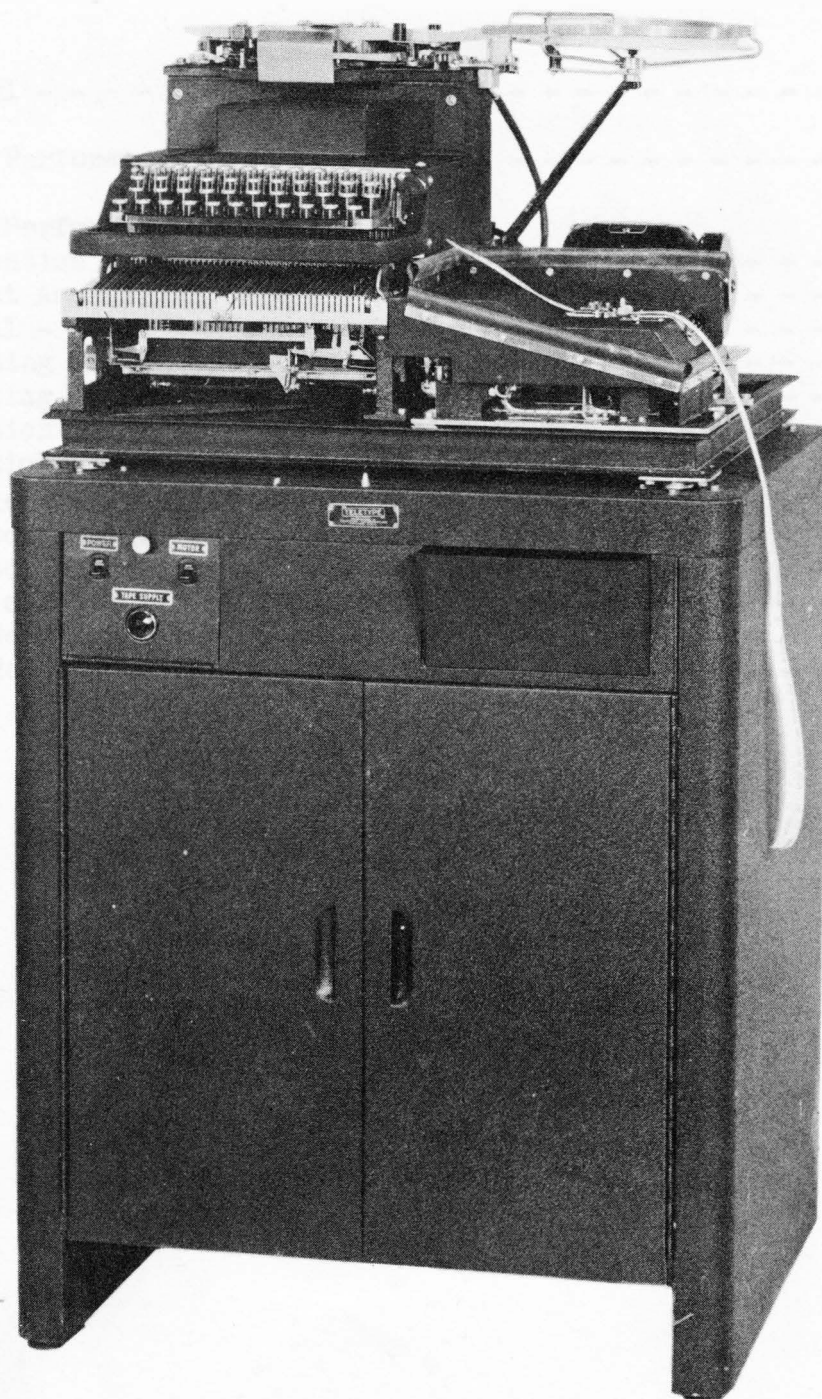
DESCRIPTION

TELETYPE AUTOMATIC WHEATSTONE

PERFORATOR SET







CONTENTS

DESCRIPTION

General - - - - -	1
Wheatstone Perforator - - - - -	1
Wheatstone Perforator Operating Unit	
Combination Key Operation - - - - -	5
Contact Assemblies - - - - -	8
General - - - - -	1
Operating Clutch Operating Mechanism - - - - -	7
Operating Mechanism - - - - -	3
Operation of AR Key Lever - - - - -	5
Operation of the Double Dash (=) Key Lever - - - - -	6
Question Mark, Blank and Diagonal (\) Key Levers - - - - -	6
Selector Clutch Operating Mechanism - - - - -	6
Selector Mechanism - - - - -	2
Shift and Unshift Mechanism - - - - -	4
Tape Feeding Mechanism - - - - -	8
Tape Release Lever Assembly - - - - -	8

DESCRIPTION

GENERAL

The Teletype Automatic Wheatstone Perforator Set provides means for automatically producing a tape perforated with continental code combinations from a five unit perforated tape. This is accomplished by the use of an operating unit which is associated with and operates the Wheatstone Perforator automatically. If desired, the Wheatstone Perforator may also be operated manually without removing it from the set. (Figure 2 shows the five unit code, key levers operated, and the "SS" key lever arrangement.)

The Automatic Wheatstone Perforator Set eliminates manual relay of messages from a start-stop telegraph circuit to ships at sea or other countries via continental code radio channels.

A complete Automatic Wheatstone Perforator Set consists of:

- 1 Wheatstone Perforator (equipped for automatic operation)
- 1 Wheatstone Perforator Operating Unit
- 1 Motor Unit
- 1 Set of Gears
- 1 Table
- 1 Cover
- 1 Rectifier (if D.C. current is not available)

WHEATSTONE PERFORATOR

The Wheatstone perforator used with the perforator set is equipped with the following mechanisms in addition to those described in Bulletin No. 125:

1. Key lever link assemblies which connect the key levers of the perforator to the operating unit code levers.
2. Mechanism for controlling the COMBINATION key lever automatically.
3. Flanged feet are used to provide means for locating and locking the perforator in its proper position over the operating unit.
4. A chad box designed so that it can be located farther to the rear of the perforator is used and a chad deflector is mounted on the chad chute to direct the chad into the chad box.
5. A tape-out contact mechanism is used to provide a visible as well as an audible warning when tape replacement is necessary.

WHEATSTONE PERFORATOR OPERATING UNIT

GENERAL

The operating unit is a motor driven mechanical device designed to provide automatic operation of a Wheatstone perforator that is equipped for automatic operation from a five-unit perforated tape.

The operating unit consists essentially of a tape feeding and selecting mechanism, code bars, code levers, selector shaft with magnet operated clutch and cam sleeve, operating shaft with a mechanically operated clutch, and end-of-tape stop mechanism. A gear mounted on the rear of the selector shaft meshes with the motor pinion. (Figure 1)

SELECTOR MECHANISM

The selector shaft (Figure 3) which actuates the selector mechanism, consists principally of two gears, a tape feed cam, selector lever bail cam, transfer lever cam, reset bail cam, detent cam, a positive clutch consisting of a driven clutch member and a driving clutch member. It derives its motive force from the motor pinion through the gear mounted on the right end of the shaft. A roller arm rides the selector lever bail cam and imparts motion to the selector lever bail which pivots on a shaft with the roller arm (Figure 4). This motion is transmitted to five selector levers positioned vertically in the selector assembly. The selector levers pivot on a shaft through their upper sections and have extensions to the right, the left, and downward. The right extensions project upward at their ends and have tape pins embedded in them. An opening is provided in a tape guide, located above the right extensions of the selector levers, to permit the tape pins to enter the perforated holes in the tape. Located below and in line with each selector lever is a T transfer lever. These T transfer levers are mounted on a shaft at the right end of a transfer bail (Figure 5). The transfer bail pivots on a shaft on which a transfer bail arm is also mounted. The roller of this arm rides the transfer cam. The motion of the roller arm is transmitted to the transfer bail through a yield spring.

When the driven clutch member of the selector shaft is held disengaged by its throwout lever (Figure 6), the roller of the selector lever bail roller arm rests on the high part of its cam (Figure 7). A yield spring connected between the selector lever bail roller arm and the selector lever bail holds the bail in its highest position. In this position, the selector lever bail holds the selector levers rotated clockwise against their stop. The tape pins will then be in their lowest position so as to clear the lower side of the tape in the tape guide. With the selector shaft cam sleeve in its stopped position, the transfer bail arm roller will rest on the low part of its cam, thus allowing the transfer bail spring to hold the T transfer levers clear of the lower extensions of the selector levers. (See Figure 5 for location of parts.) When the selector shaft clutch is engaged and the selector cam sleeve starts to rotate, the selector lever bail arm roller rides to the low part of its cam, thereby permitting the right end of the selector lever bail to be moved downward by its spring (see Figure 4). The selector levers then respond to the action of their springs, attached to the right side of their lower extensions, and rotate counterclockwise.

If tape, perforated with code combinations, is in the tape guide at this time, the selector levers opposite these perforations will project their pins through the holes in the tape as they rotate counterclockwise against their stop; while the other selector levers will be held in their clockwise position, because their pins strike the unperforated portions of the tape. The transfer bail arm roller then rides to the high part of its cam and in so doing moves the T transfer levers upward against the selector levers (Figure 5). Under this condition, the operated selector levers (those which have tape pins

through perforations in the tape) have their lower right extensions in line with the right arm of their respective T transfer levers. The unoperated selector levers (those which have tape pins against the tape) have their lower left extensions in line with the left arms of their respective T transfer levers. As operation continues, those T transfer levers engaging the operated selector levers, rotate clockwise, whereas, those T transfer levers engaging the unoperated selector levers rotate counterclockwise.

The lower extension of each T transfer lever engages a slot at the right end of a transfer bar (Figure 4). Assembled in a slot at the left end of each transfer bar is a vertical code bar link which pivots on its shaft at approximately its midpoint. The top end of each code bar link is assembled in a slot at the right end of a code bar, which is a comblike bar extending to the left across the width of the Wheatstone Perforator. Located in front and parallel to the five code bars is a shift code bar similar to the code bars (Figure 8). Above and at right angles to these code bars are forty-one code levers and four unshift or shift code levers (Figures 8, 9, and 10). The code levers have six comblike projections, whereas the unshift or shift code levers have five comblike projections. These projections point downward directly above the upward projections of the code bars. The projections on the code levers are formed to the right or left according to the requirements of the five unit code (Figure 11). A link connects each code lever to its respective key lever of the Wheatstone Perforator (Figure 12). Each T transfer lever that is rotated clockwise will move a transfer bar to the left (Figure 4). This movement, in turn, will cause the code bar link to rotate on its shaft in a clockwise direction, thereby pulling its code bar to the right in a selected position.

It should be noted that if one or more code bars do not require a change in position from the previous selection, there will be no engagement between the corresponding selector levers and their associated T transfer levers.

All movements or parts up to this point have been brought about through the operation of cams on the selector shaft.

OPERATING MECHANISM

Located below and at right angles to the selector shaft is an operating shaft which extends across the left portion of the operating unit under the Wheatstone Perforator. A positive clutch consisting of a driving clutch member and a driven clutch member, a gear, and five cams are mounted on this shaft - two load compensating cams, one latch lever operating cam, and two code lever bail operating cams (Figure 13). Mounted over and enclosing the code lever bail operating cams are two ball bearing eccentrically mounted cam followers. These cam followers are attached to and operate the code lever bail which crosses the left section of the unit under the rear end of the code levers (Figure 10). This shaft is driven by a gear mounted near the center of the selector shaft.

After the code bars have been positioned as previously described, the eccentrically mounted cam followers follow their cams downward and cause the code lever bail to be lowered. Since all code levers were held in their uppermost position by the code lever bail, they are now permitted to respond to the

pull of their springs and move downward. The toothlike projections of the selected code bars are positioned in such a manner that they block the toothlike projections of all code levers except one (Figure 11). The projections of this selected code lever are permitted to pass downward among the code bars to pull a key lever of the Wheatstone Perforator downward through the medium of its link which connects the code lever to the key lever (Figure 12).

Thus it may be seen that the five-unit code combination set up by a tape in the selecting mechanism may, through the operation of this unit, select and operate the key lever of the Wheatstone Perforator that corresponds to that code combination (Figure 2).

A load compensating shaft is located behind the operating shaft. It has two cam followers assembled to it that extend to the operating shaft. Two rollers are assembled to the forward end of these cam followers and ride on the compensating cams of the operating shaft. These rollers are held firmly against the compensating cams due to the constant pull of two springs which are hooked to their cam followers (Figure 13). The purpose of this assembly is to equalize the load of the motor as the unit operates.

A latching mechanism is provided to latch the Wheatstone Perforator firmly in place on the operating unit. This mechanism, located above the compensating shaft, consists of a transverse rod, two latches, two springs, and a latch release lever (Figure 14). When the perforator is placed on the operating unit and pulled forward, the flanged feet of the Wheatstone Perforator become latched in position by this mechanism and can be moved only after the latch release lever has been pressed. See Figure 12.

Both the selector shaft and the operating shaft are equipped with a one tooth clutch assembly which insures proper timing between the selecting mechanism and the operating mechanism. Each shaft is also equipped with a detent lever and roller assembly to insure complete disengagement of the clutch teeth in the stop position (Figure 15 and 16).

SHIFT AND UNSHIFT MECHANISM

Located under the key levers and in front of the code bars is the Shift and Unshift mechanism. It consists of a shift code bar, assembled in the same plane and parallel to the five code bars of the selecting mechanism, a shift bell crank, yield lever, unshift link, unshift bell crank, unshift bell crank latch, shift code lever, unshift code lever, two code lever slides, and springs (Figure 8). The code lever slides are assembled to the shift and unshift code levers by means of screws. The shift bell crank and yield lever are mounted and pivot on the same center. They are connected by a yield spring and operate against a lug mounted on the shift code bar. The unshift link connects the unshift bell crank to the shift bell crank latch. The function of this mechanism is to move the shift code bar to the left (LETTERS) position or to the right (FIGURES) position.

When the FIGURES code combination is selected by the selector mechanism the projections on the code bars are positioned so as to provide a path for the projections on the shift code lever. As the shift code lever moves downward through the path provided for it, its code lever slide engages the right extension of the shift bell crank, causing it to turn clockwise

until it is latched by the shift bell crank latch (See Figure 8 for location of parts). The upper extension is also moved to the right out of engagement with the lug on the shift code bar. Inasmuch as the projections of all the code levers are resting on the projections of the shift code bar during this operation, the shift code bar is not free to move at this time. A yield lever and spring are provided to exert pressure on the lug and cause the shift code bar to move to the right (FIGURES position) as soon as it is free from the code levers. Upon completion of the next upward movement of the code lever bail, all code levers are lifted above the code bars and the code bars are free to be moved by the selecting mechanism. See Figure 10. At this time the shift code bar responds to the tension exerted by the yield spring and moves to the right-hand (FIGURES) position. The shift code bar will remain in this position and all selections will be in the upper case until the unshift code lever is operated.

When the LETTERS code combination is selected by the selector mechanism, the projections of the code bars are positioned so as to provide a path for the projections on the unshift code lever. As the unshift code lever moves downward, its code lever slide (which is assembled to it) engages the unshift bell crank. The unshift bell crank then rotates counterclockwise and pulls the shift bell crank latch out of engagement with the notch on the shift bell crank. The upper extension of the shift bell crank will exert pressure against the lug on the shift code bar until the upward movement of the code lever bail lifts the code levers off the code bars as described in the foregoing paragraph. The shift bell crank then turns in a counterclockwise direction in response to the tension exerted by the shift bell crank spring as shown in Figure 8. As this bell crank turns, its upper extension causes the shift code bar to move to the left (LETTERS position). The shift code bar will remain in this position and all selections will be in the lower case until the shift code lever is operated.

COMBINATION KEY OPERATION

The combination key lever is operated in the same manner as any other key lever except that when it is pulled downward by its code lever, through the medium of its link, it becomes latched by a latch link mechanism attached to the left side of the Wheatstone Perforator under the key levers. When the BLANK code combination is selected by the selector mechanism, the combination key lever is pulled downward and latched in the selected position. Its code lever, however, returns to its upward position with the upward stroke of the code lever bail. The combination key lever remains in this position and all selections are made in combination on the Wheatstone Perforator until the SPACE selection is made. When the SPACE code combination is set up by the selector mechanism the space bar is operated and the left space key lever engages a pawl and unlatches the combination key lever latching mechanism, thereby permitting the combination key lever to return to its unselected position.

OPERATION OF THE AR KEY LEVER

The mechanisms of this unit are so arranged that the AR key lever of the Wheatstone Perforator is operated by selection of the carriage return code combination in the upper case only.

OPERATION OF THE DOUBLE DASH (=) KEY LEVER

The double dash (=) key lever can be operated only upon the sequential selections of the code combination for carriage return followed by line feed in the LETTERS position. This is accomplished by means of a latching mechanism located under the code levers and in front of the code bars. It consists of a latch bracket, latch lever assembly, latch, link, and a bell crank (Figure 17). A roller assembled to the latch lever rides a small cam on the operating shaft (see Figure 13). The link is mounted by an elongated hole so that it may be moved up and down. The lower end of the link is assembled to an extension of the bell crank. The bell crank is mounted to and pivots on the same post as the shift bell crank previously described. (See Figure 8.) The bell crank has an upper extension, positioned directly under the double dash code lever that serves to block selection of the code lever unless the extension has been moved out of the path of the code lever as shown in Figure 18.

In order to move the bell crank extension out of the path of the code lever so that the double dash key lever may be operated, the code combination for Carriage Return in the LETTERS position must be selected by the selector mechanism. When this code combination is selected, the code lever, which is in line with the question mark key lever of the Wheatstone Perforator, is operated. (This code lever is not connected to the question mark key lever, therefore the key lever will not be operated.) As this selected code lever moves downward, it engages the link of the latching mechanism, moving it downward. Since the link is connected to the bell crank, the bell crank turns counterclockwise, moving the upper extension from under the double dash code lever. The bell crank is then latched as shown in Figure 18. The mechanism remains in this position until the next selection (which is Line Feed) reaches the operating mechanism and causes the double dash code lever to move downward (Figure 18). At this instance the roller on the latch lever rides to the high part of its cam on the operating shaft and causes the bell crank to unlatch. The bell crank then rotates clockwise in response to the tension exerted by its spring and strikes the side of the double dash code lever. The double dash code lever, having moved far enough downward that it cannot be blocked by the upper extension of the bell crank, is permitted to operate its key lever. It should be noted that this action all takes place during one revolution of the operating shaft.

QUESTION MARK, BLANK AND DIAGONAL KEY LEVERS

It is to be noted that the QUESTION MARK (?) key lever (No. 34), the BLANK key lever (No. 43), and the DIAGONAL (\) key lever (No. 44) are not actuated by the operating unit. (See Figure 2.)

SELECTOR CLUTCH OPERATING MECHANISM

The selector clutch is operated by a magnet through a mechanism consisting of a set of magnets, an armature and armature lever, armature latch, clutch throwout lever, a clutch throwout lever extension, and a clutch reset bail and roller (Figure 6). The armature latch is clamped to the armature lever, and the clutch throwout lever extension is clamped to the clutch throwout lever. The clutch throwout lever pivots on the same center as the clutch reset bail. It has a camming surface near its upper end that engages the camming surface of a lug on the driven clutch member when the magnet is not

energized (Figure 6). When the magnet is energized it attracts its armature and causes the clutch throwout lever extension to unlatch. The extension then rotates counterclockwise by the pull of its spring and disengages the clutch throwout lever from the driven clutch member. The one tooth clutch driven member then engages the driving clutch member and the cam sleeve assembly begins rotating.

The roller of the reset bail rides a cam on the cam sleeve assembly and actuates the clutch throwout lever with each revolution of the cam sleeve assembly. This motion moves the armature extension to the latching position during each revolution of the cam sleeve assembly, but as long as the armature is attracted the armature latch is out of its path and no latching takes place (Figure 19). When the magnet is de-energized the armature latch moves into the path of the clutch throwout lever extension and latches it in its downward position as shown in Figure 6. The clutch throwout lever then engages the lug on the driven clutch member which, in turn, disengages the clutch tooth from the driving clutch member and brings the cam sleeve assembly to a stop.

OPERATING CLUTCH OPERATING MECHANISM

The operating clutch operating mechanism is mechanically operated by a cam on the selector cam sleeve assembly through the medium of a release arm which rides the cam. The mechanism consists of a clutch throwout lever latch assembly, a clutch throwout lever, a release arm, and a reset bail assembly (Figure 20). The reset bail roller rides a cam on the operating cam sleeve assembly and actuates the throwout lever each revolution of the cam. The throwout lever latch assembly is actuated, against the tension of its spring, by a release arm which rides a cam on the selector cam sleeve assembly.

When the operating mechanism is at rest in its stop position, the release arm is on the low part of its cam. The throwout lever latch assembly is responding to the tension exerted by its spring causing a notch on its lower extension to be engaged with the throwout lever (Figure 20). The reset bail roller is suspended opposite the low part of its cam and the camming surface of the throwout lever is engaged with the lug on the driven clutch member. In this position the one tooth driven clutch member is disengaged from the driving clutch member. As the selector cam sleeve assembly begins to rotate the release arm rides to the high part of its cam and raises the left extension of the throwout lever latch assembly causing the notch on the lower extension of the throwout lever latch assembly to unlatch the throwout lever. The throwout lever spring then lifts the throwout lever out of engagement with the lug on the driven clutch member (Figure 21). Meanwhile, the cam sleeve is held in position by its detent lever and roller assembly (Figure 16).

During the next revolution of the operating shaft the one tooth clutch members engage and the operating cam sleeve assembly begins rotating. As operation continues the mechanism is so assembled and adjusted that the lower extension of the throwout lever latch assembly moves out of the path of the throwout lever and no latching takes place until after the selector cam sleeve assembly comes to a stop. After the selector cam sleeve assembly is stopped, the operating cam sleeve continues rotating through a part of one revolution until its operation is completed and the throwout lever becomes latched, thereby disengaging the clutch members.

TAPE FEEDING MECHANISM

The tape feeding mechanism consists of a tape feed lever extension, roller, adjusting screw, tape feed lever, tape feed lever spring, tape feed pawl, spring, feed roll assembly, detent lever, roller, and compression spring (Figure 22). The tape feed lever extension roller rides a cam on the selector cam sleeve assembly. The compression spring holds the detent roller in engagement with the feed wheel ratchet on the feed roll assembly through the medium of the detent lever. As the roller on the tape feed lever extension rides to the high part of its cam, the feed pawl is moved upward through the medium of the tape feed lever extension and the tape feed lever. The tape feed pawl spring presses the feed pawl against the feed wheel ratchet. When the tape feed lever extension roller rides to the low part of its cam the tape feed lever responds to the tension exerted by its spring and pulls the feed pawl downward. In moving downward it engages a tooth on the feed wheel ratchet and rotates the feed roll.

The feed roll has pins on its periphery that engage the feed holes in the tape (Figure 23). As the feed roll rotates, the tape is advanced through the tape guide. At the same time the detent roller rides over a tooth on the feed wheel ratchet and brings the feed roll to rest in a position that insures equal spacing between the perforations in the tape.

TAPE RELEASE LEVER ASSEMBLY

Assembled to the detent lever is a tape release lever (Figure 22). It pivots on the same center as the detent lever and serves a dual purpose. First, it stops tape feeding, as well as the entire operating mechanism; and, second, it frees the feed roll so that tape may be moved in either direction through the transmitter without raising the retaining lid. The lever has five extensions, all of which play a part in the purpose for which it is intended. One extension projects up through an opening in the transmitter plate and serves as a manual operating lever. When this lever is moved to the left, the second extension opens a contact which breaks the circuit to the clutch magnet. This stops the operating mechanisms. At the same time the third extension engages a pin on the feed pawl and moves the feed pawl out of engagement with the feed roll; while the fourth extension engages and moves the detent lever out of engagement with the feed roll ratchet. The feed roll is then free to be rotated in either direction. A fifth extension moves over a detent spring to hold the lever in its operated position.

CONTACT ASSEMBLIES

There are three contacts and one toggle switch wired into the circuit that passes through the selector clutch magnet.

- (1) The end-of-tape stop pin located in the tape guide extends downward and operates a contact (Figure 24). When the retaining lid is closed with tape in the guide the end-of-tape stop pin is pressed downward and closes the contact. When tape is removed from the top of the end-of-tape stop pin, the contact opens.

- (2) To the right of the transmitter is the tight tape bracket and contact assembly (Figure 25). A tight tape rod is formed into a loop through which the tape passes. When the tape becomes tangled or too tight for any reason, the contact is made to open and break the circuit to the selector clutch magnet.
- (3) Located under the transmitter plate is another contact which opens when the tape release lever is operated as previously described.
- (4) A toggle switch located on a bracket to the right side of the unit also completes the circuit to the selector clutch magnet.

It should be noted that if any contact or the toggle switch is open the selector clutch magnet cannot be energized and the unit will not operate.

A load resistor contact* operated by the selector magnet armature (Figures 6 and 19) serves to control resistance to the motor. When the contact is closed resistance to the motor is lightened. When the contact is open more resistance is added to the motor. This tends to keep the motor at a constant speed under load or no load conditions.

- (*) This contact is used in connection with governed motors only.

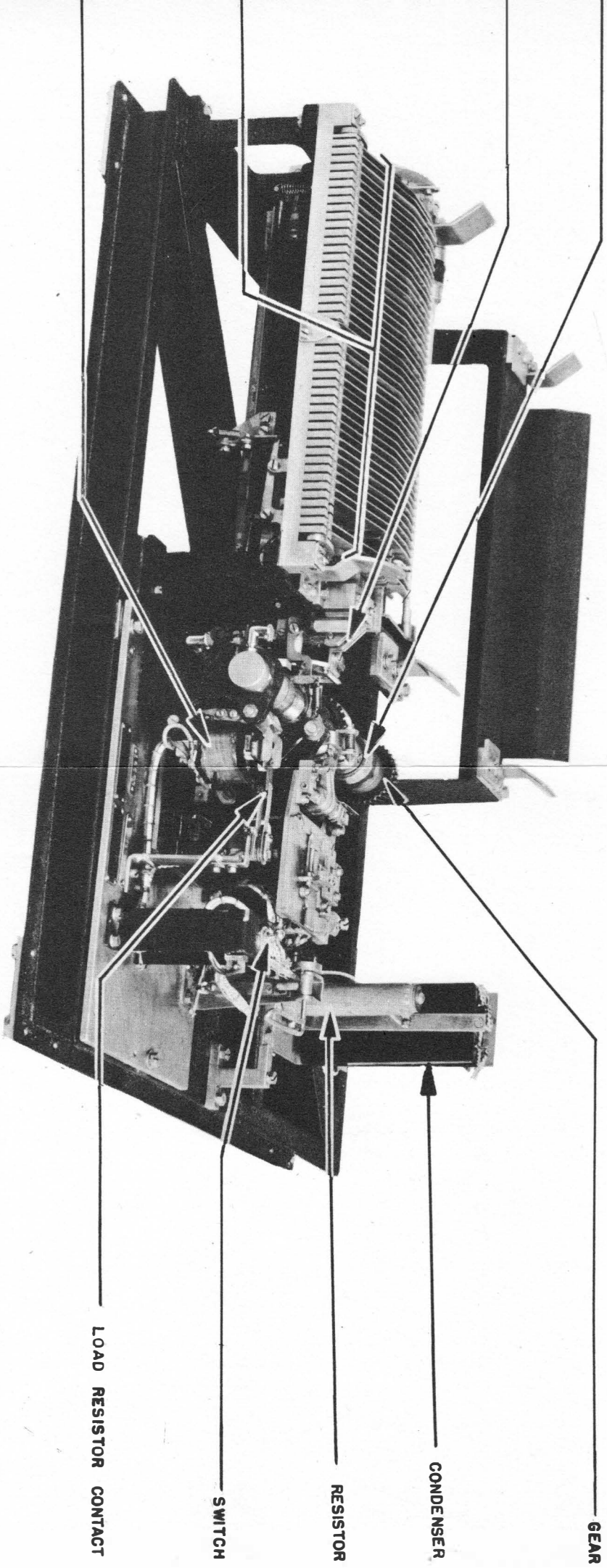


FIGURE 1

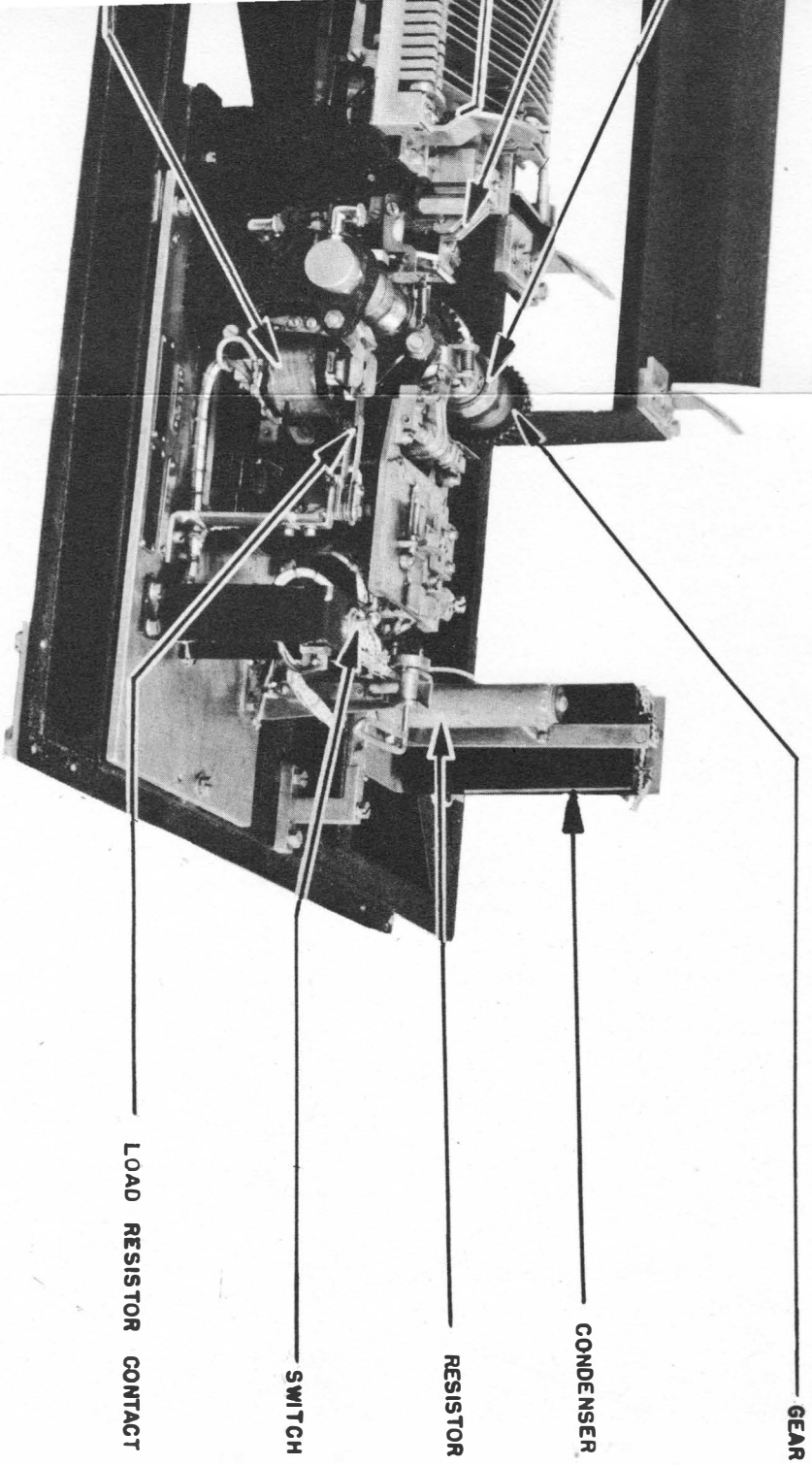
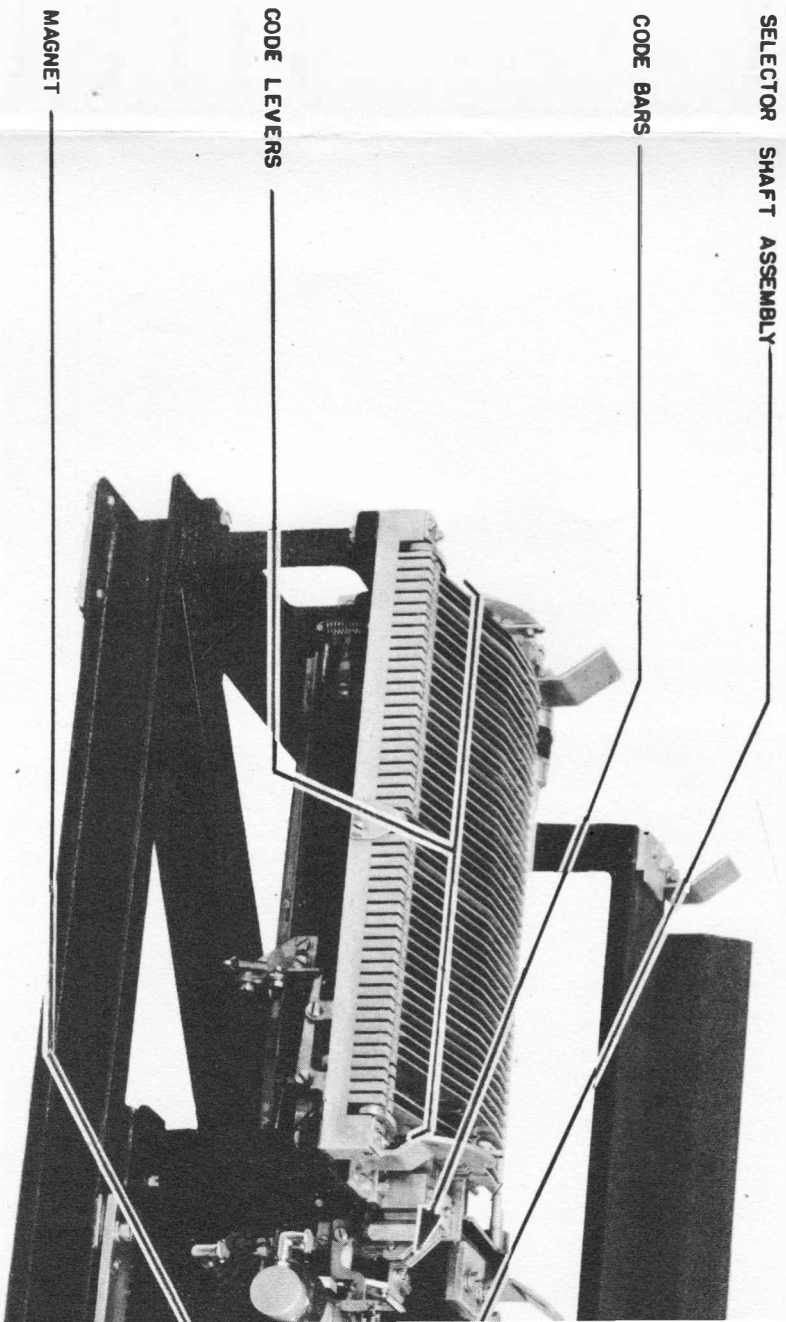
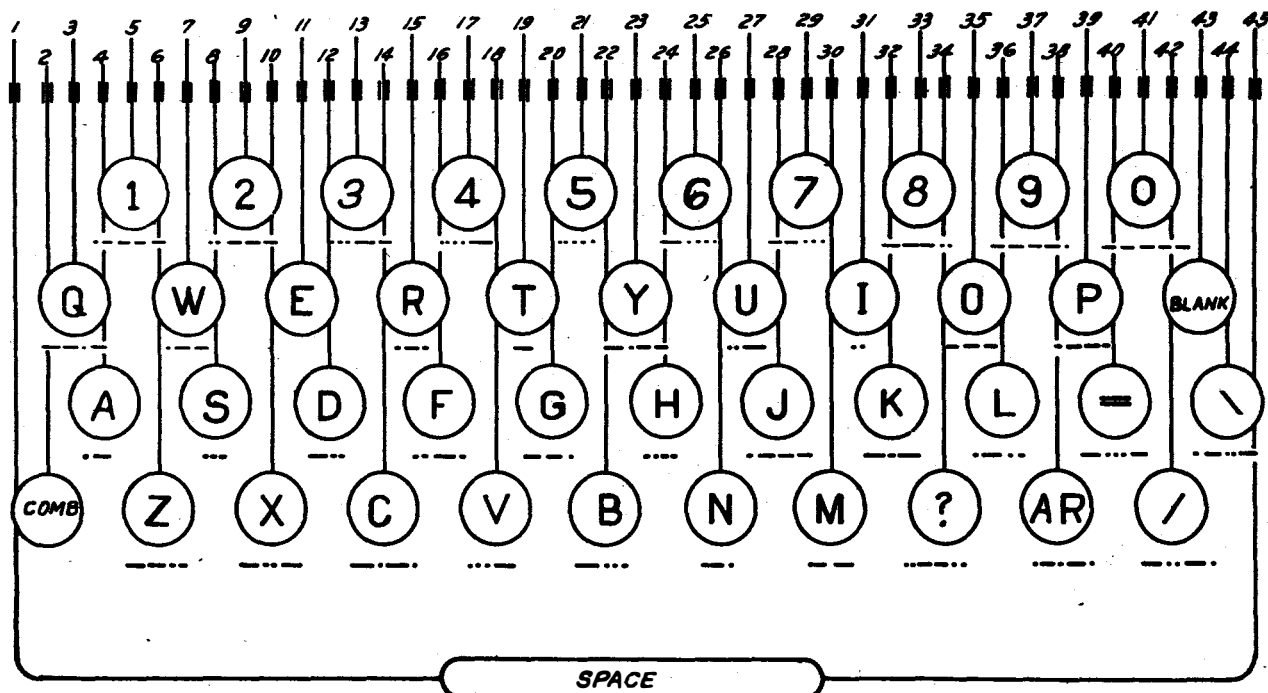


FIGURE 1



FIGURE



KEY LEVER ARRANGEMENT "SS"

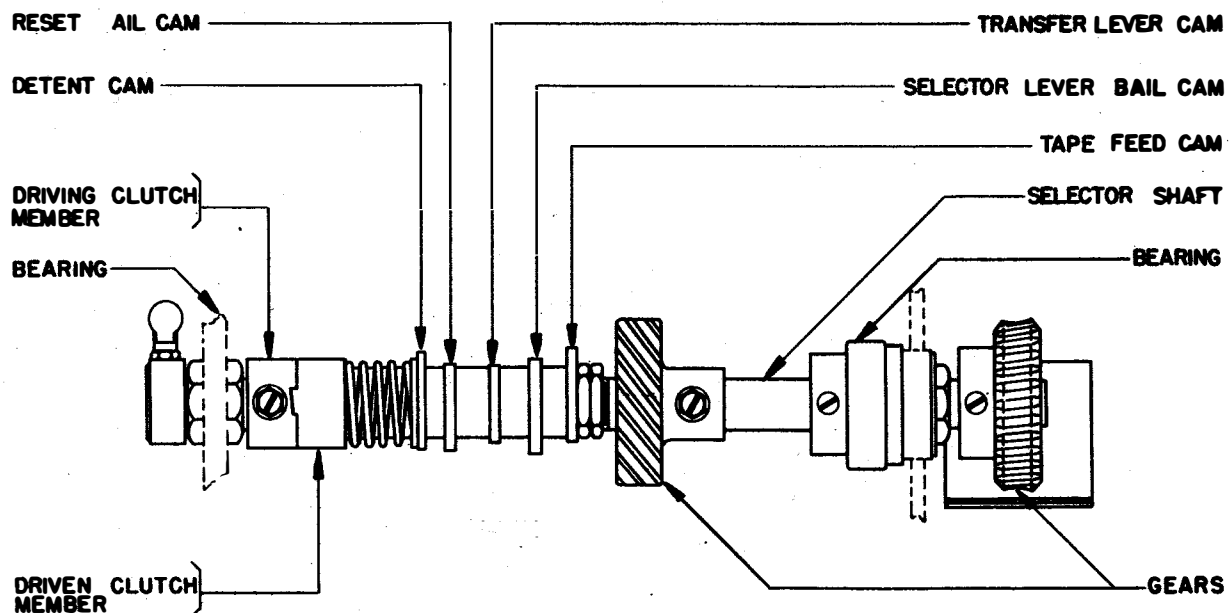
(A)

KEY LEVER OPERATED ON WHEATSTONE PERFORATOR WITH "SS" KEY LEVER ARRANGEMENT																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
UPPER CASE									3									8							9	0	1	4	5	7	2	/	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					

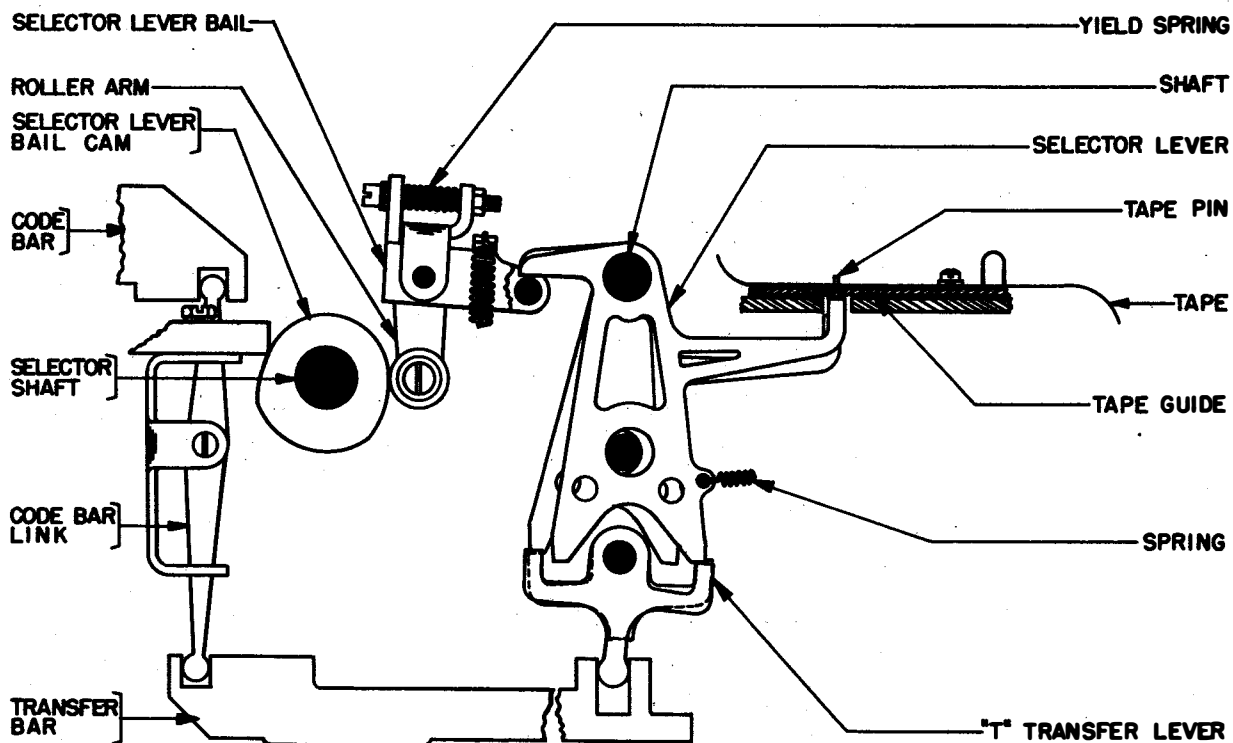
- NOTE 1: LATCHES COMBINATION KEY LEVER IN OPERATED POSITION.
 NOTE 2: THE DOUBLE DASH CHARACTER IS OPERATED ONLY ON THE SEQUENTIAL SELECTION OF CAR. RET. AND LINE FEED IN LOWER CASE.
 NOTE 3: OPERATES SPACE LEVER AND UNLATCHES COMBINATION KEY LEVER.
 NOTE 4: POSITIONS SHIFT CODE BAR OF THE OPERATING UNIT FOR UPPER CASE SELECTIONS.
 NOTE 5: POSITIONS SHIFT CODE BAR OF THE OPERATING UNIT FOR LOWER CASE SELECTIONS.

(B)

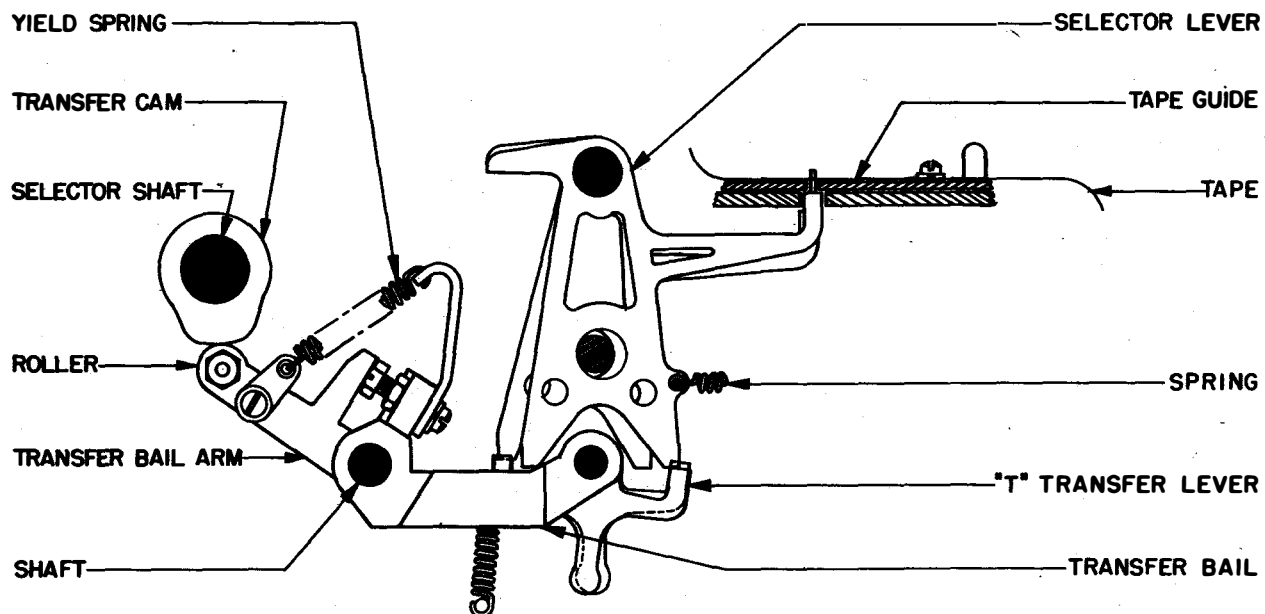
FIGURE 2



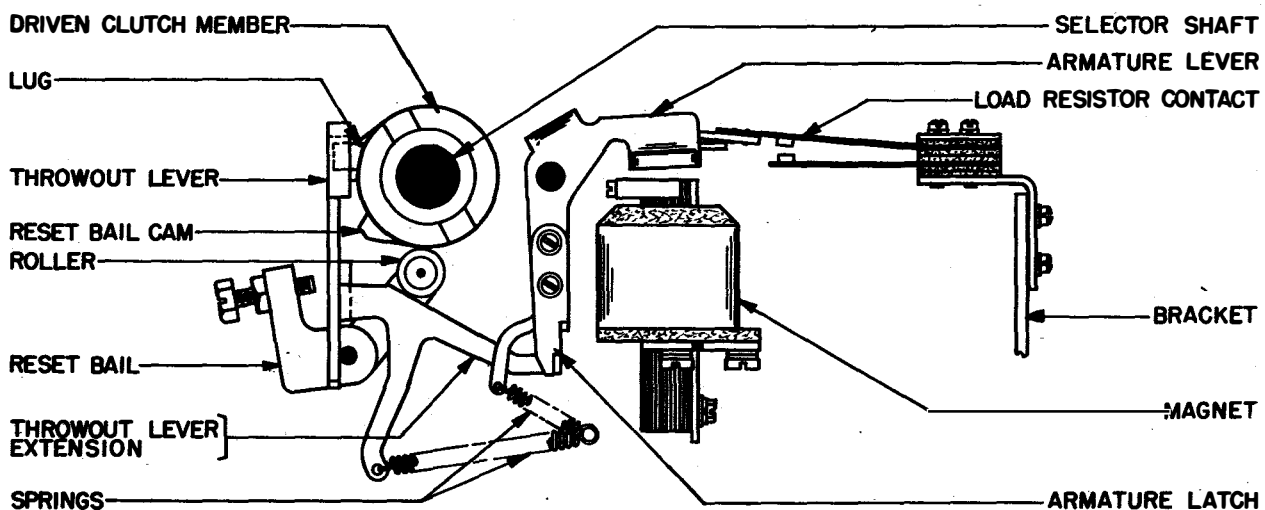
TOP VIEW
FIGURE 3



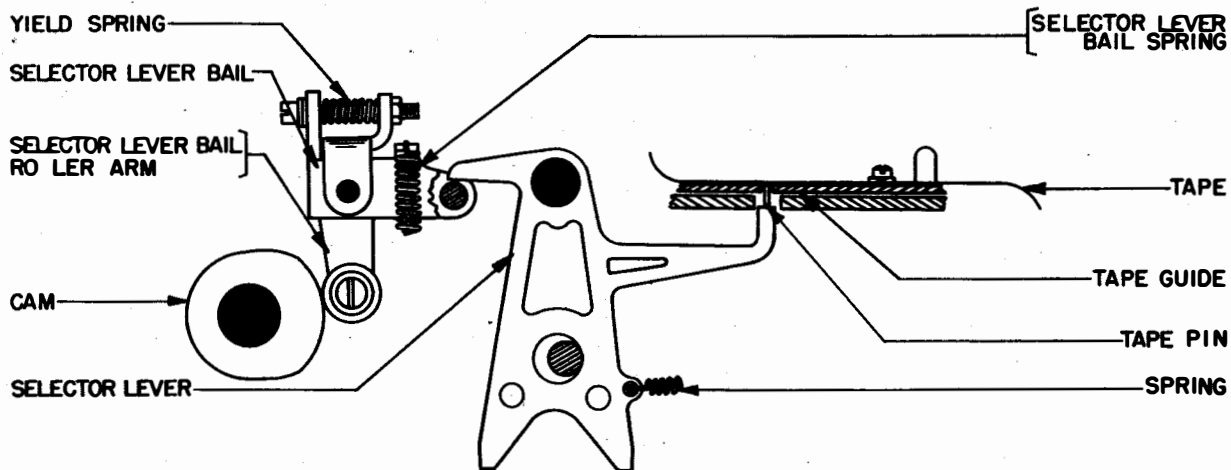
FRONT VIEW
FIGURE 4



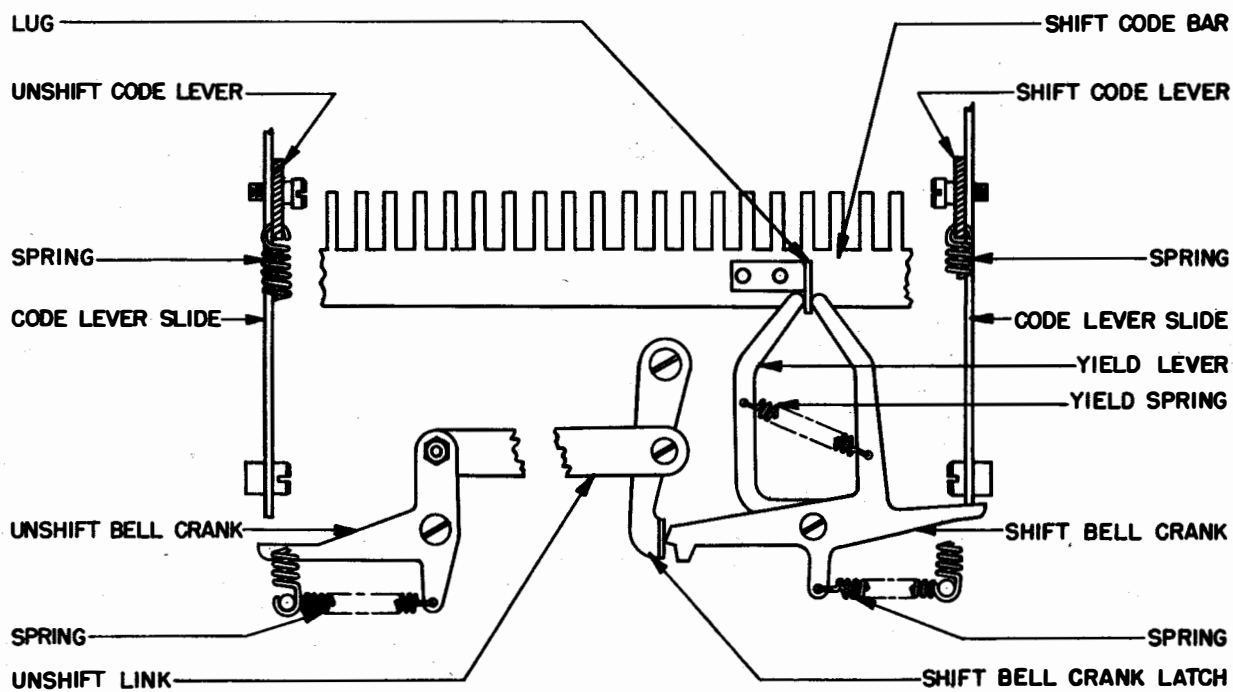
FRONT VIEW
FIGURE 5



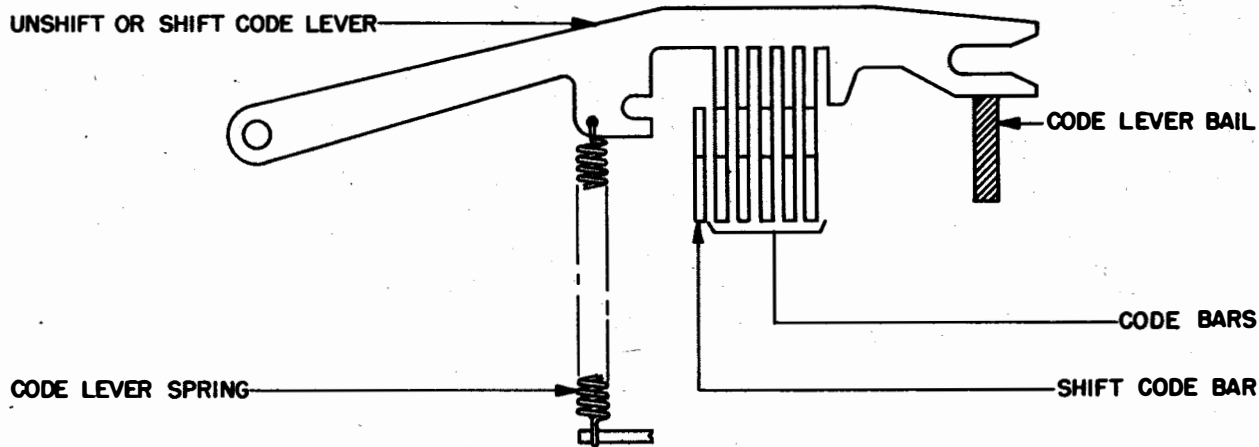
FRONT VIEW
FIGURE 6



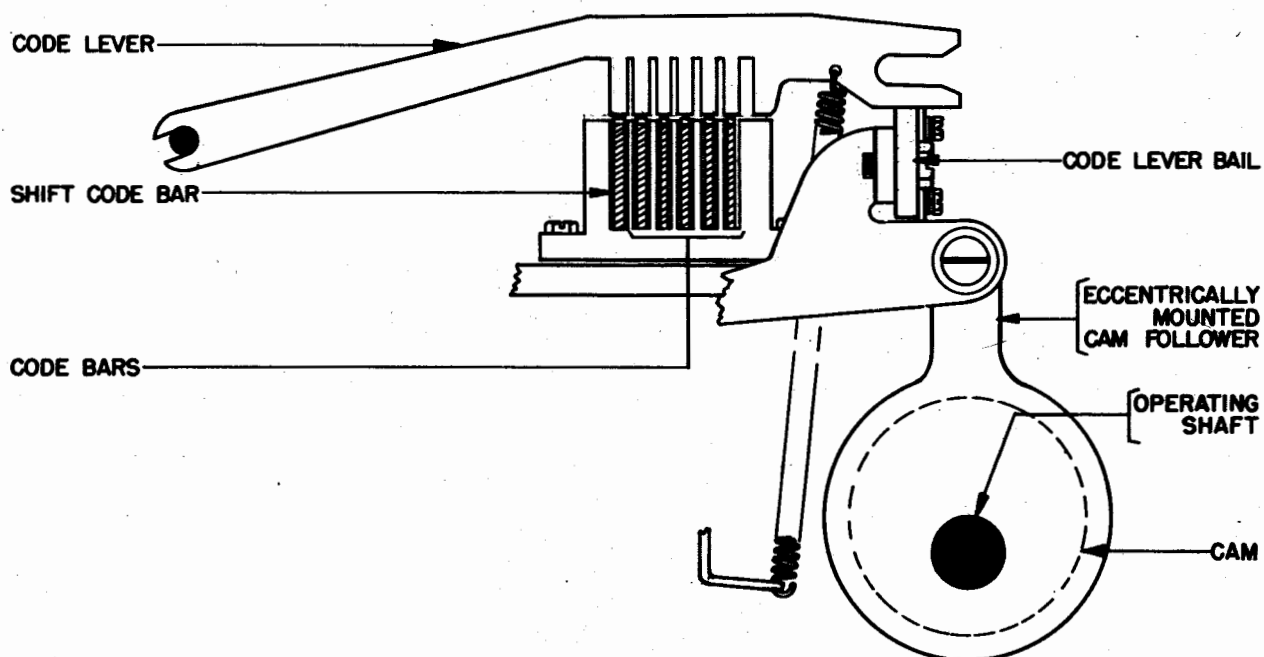
FRONT VIEW
 FIGURE 7



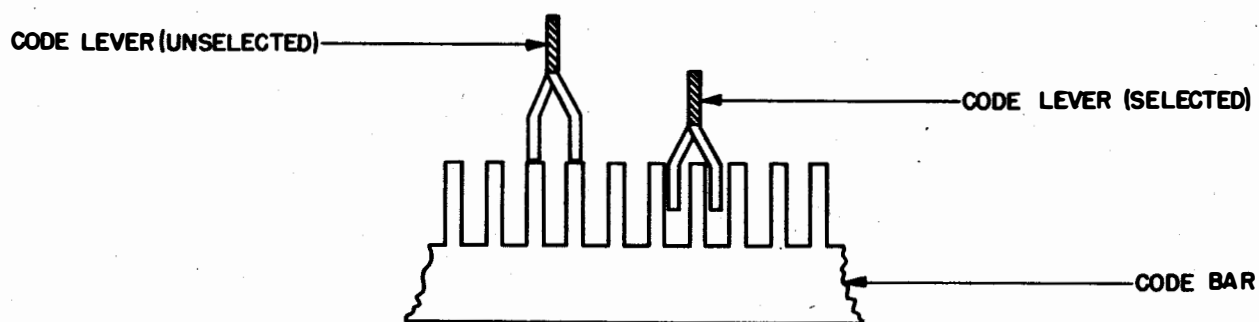
FRONT VIEW
 FIGURE 8



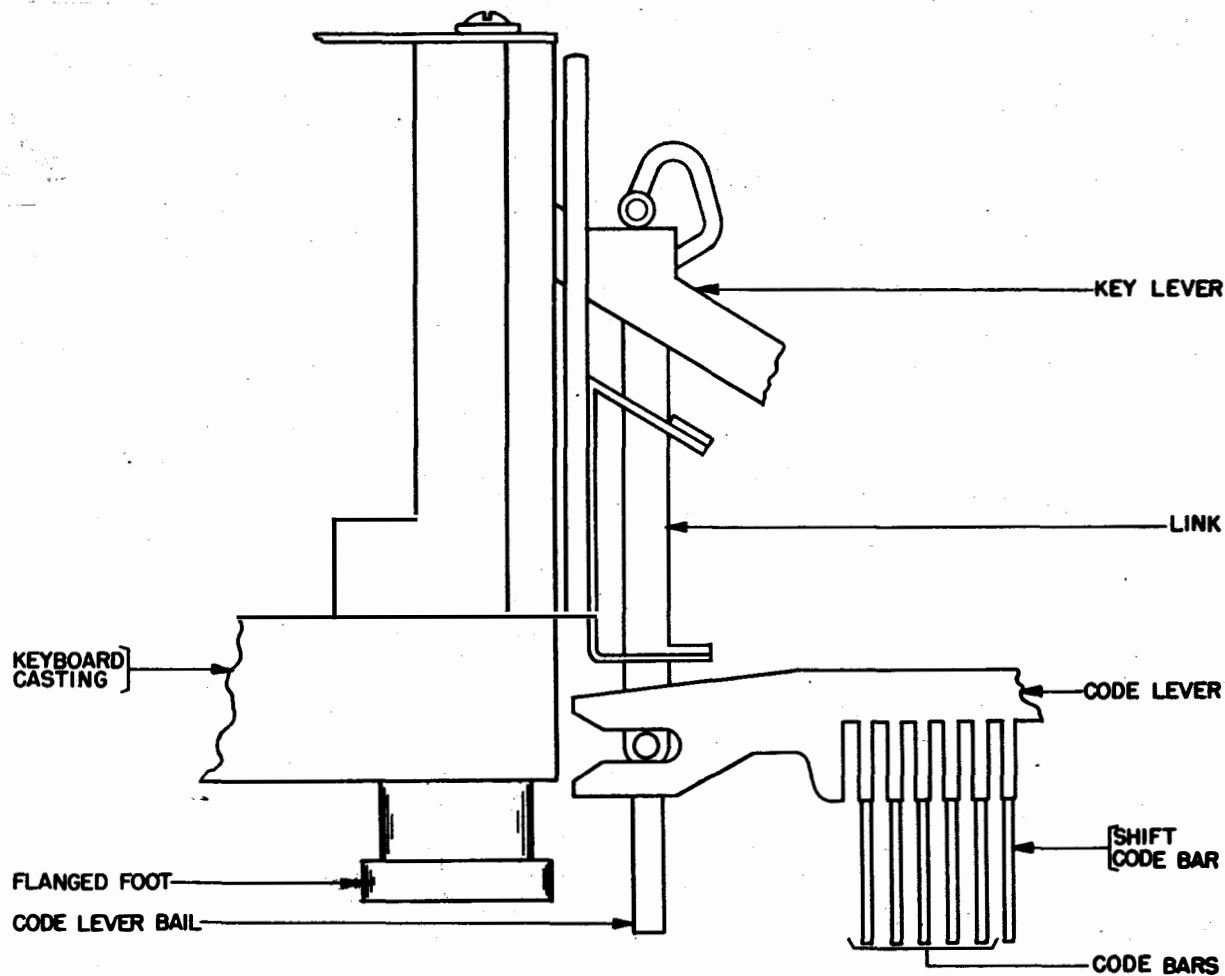
RIGHT SIDE VIEW
FIGURE 9



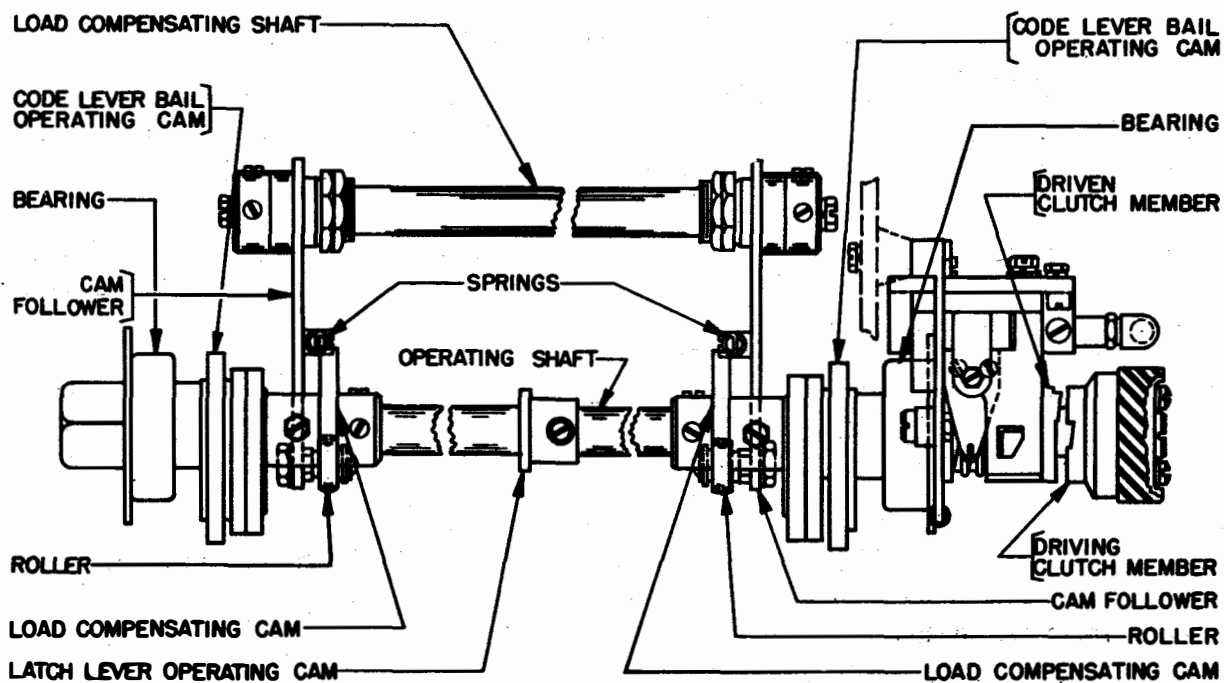
RIGHT SIDE VIEW
FIGURE 10



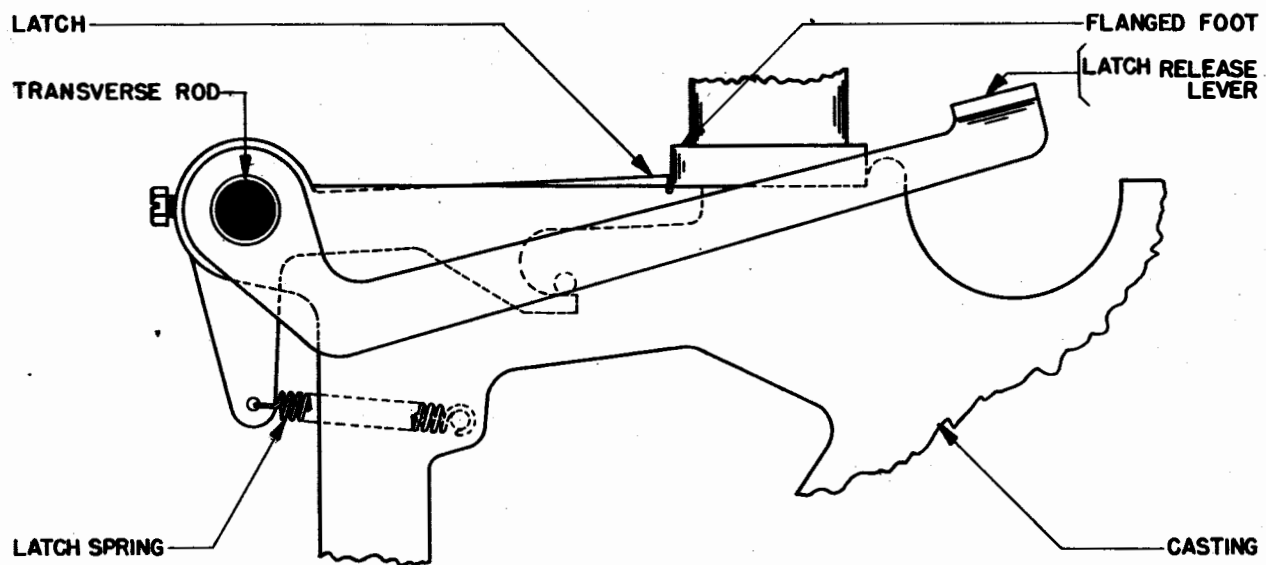
FRONT VIEW
FIGURE 11



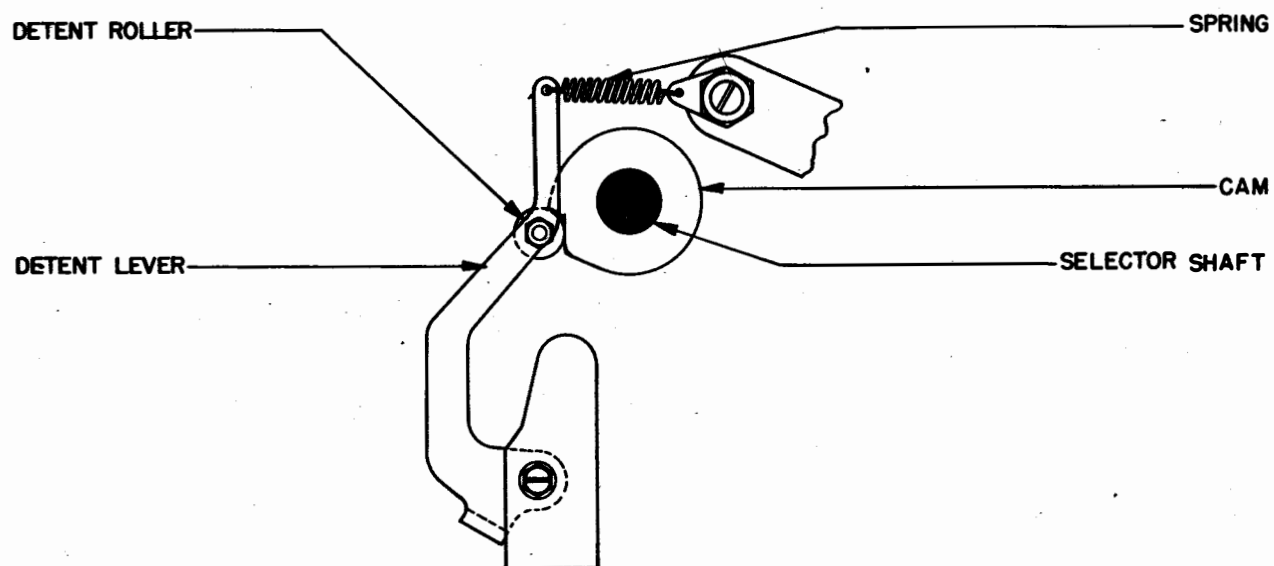
LEFT SIDE VIEW
FIGURE 12



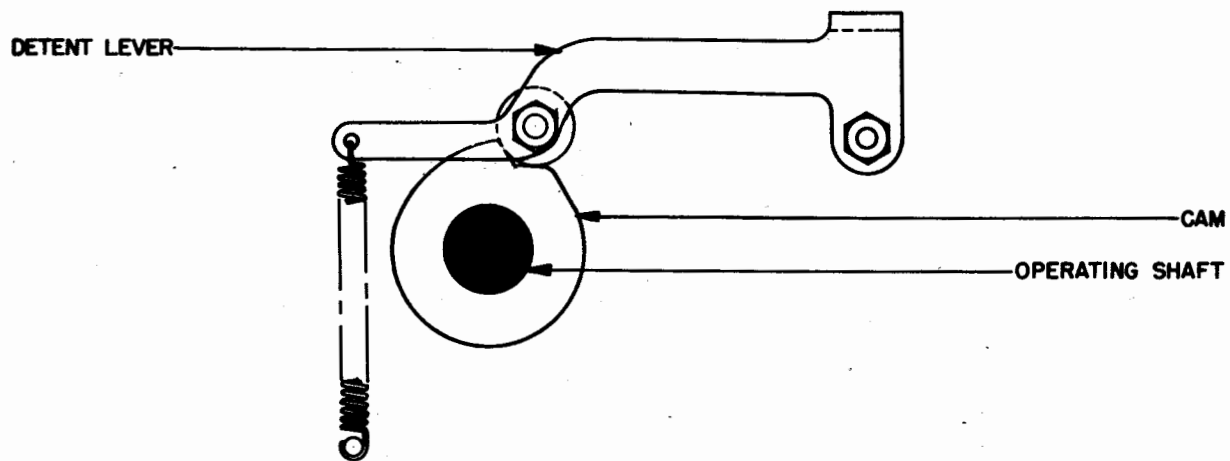
TOP VIEW
FIGURE 13



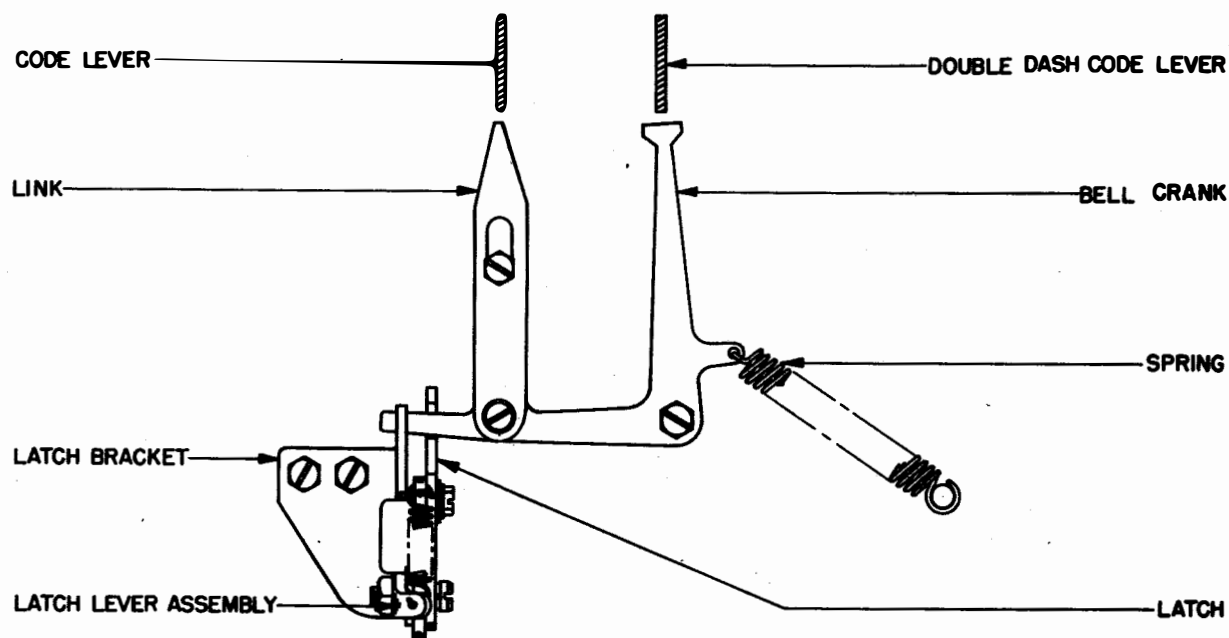
LEFT SIDE VIEW
FIGURE 14



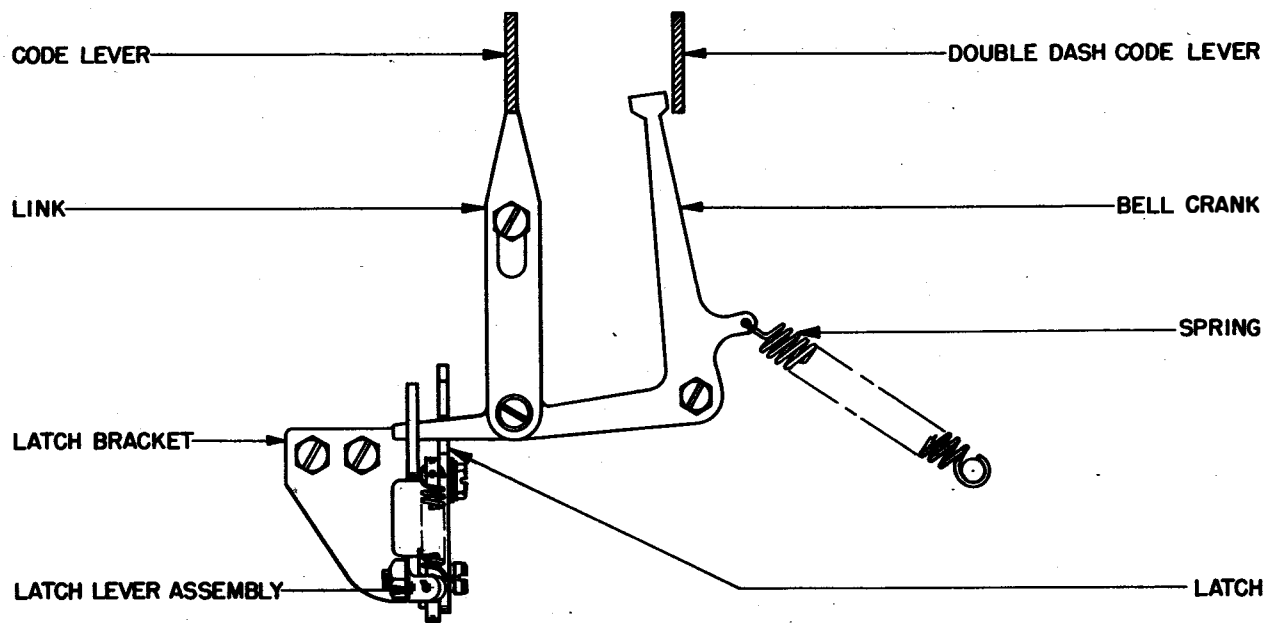
FRONT VIEW
FIGURE 15



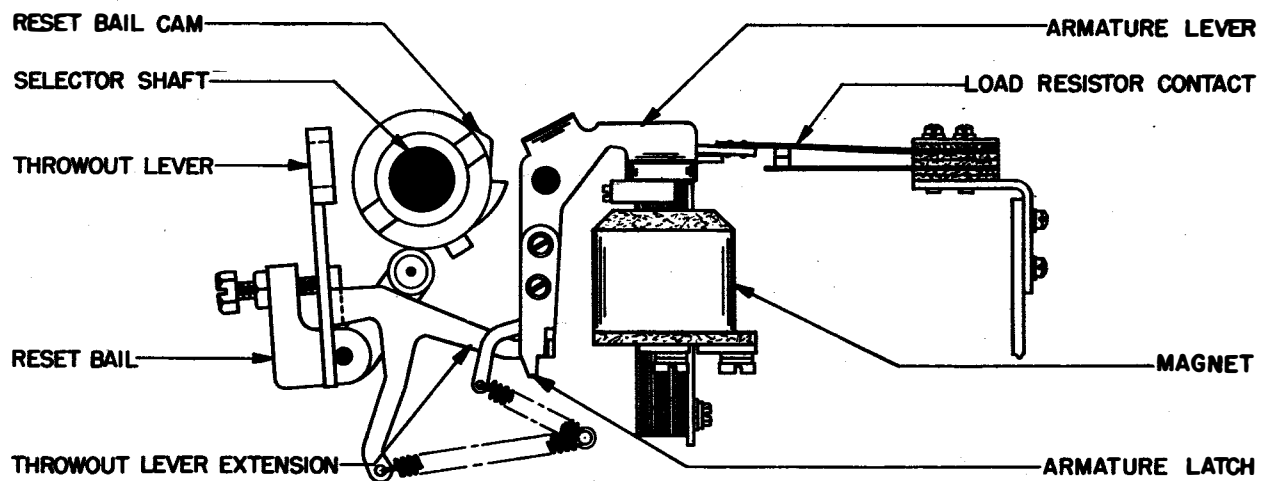
RIGHT SIDE VIEW
FIGURE 16



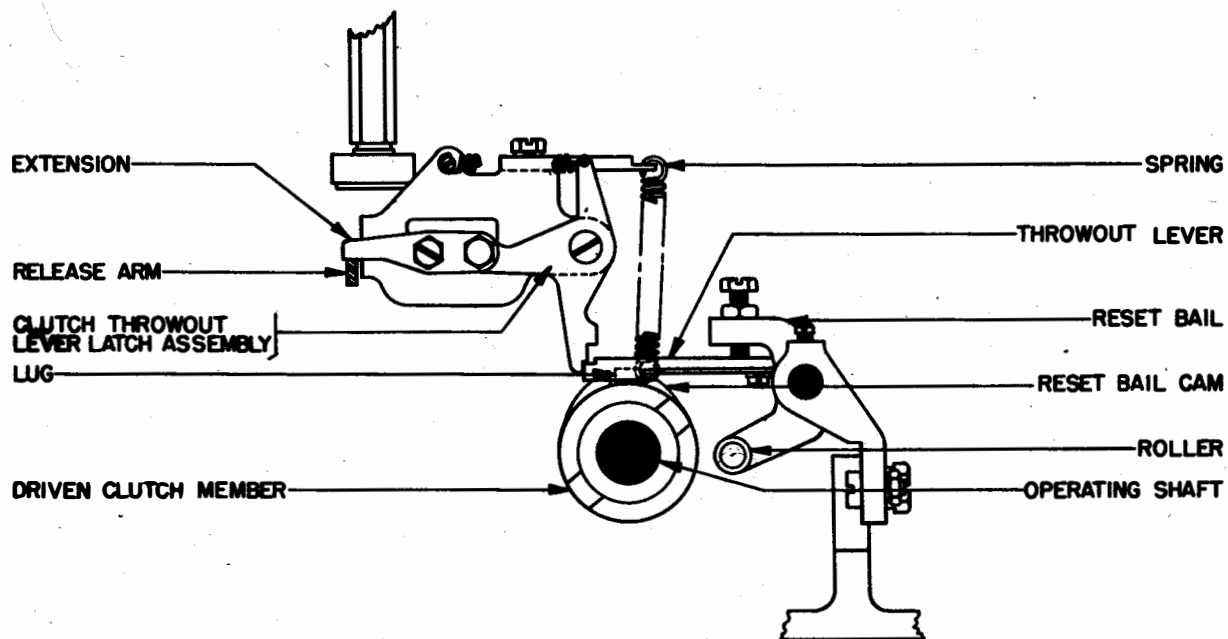
FRONT VIEW
FIGURE 17



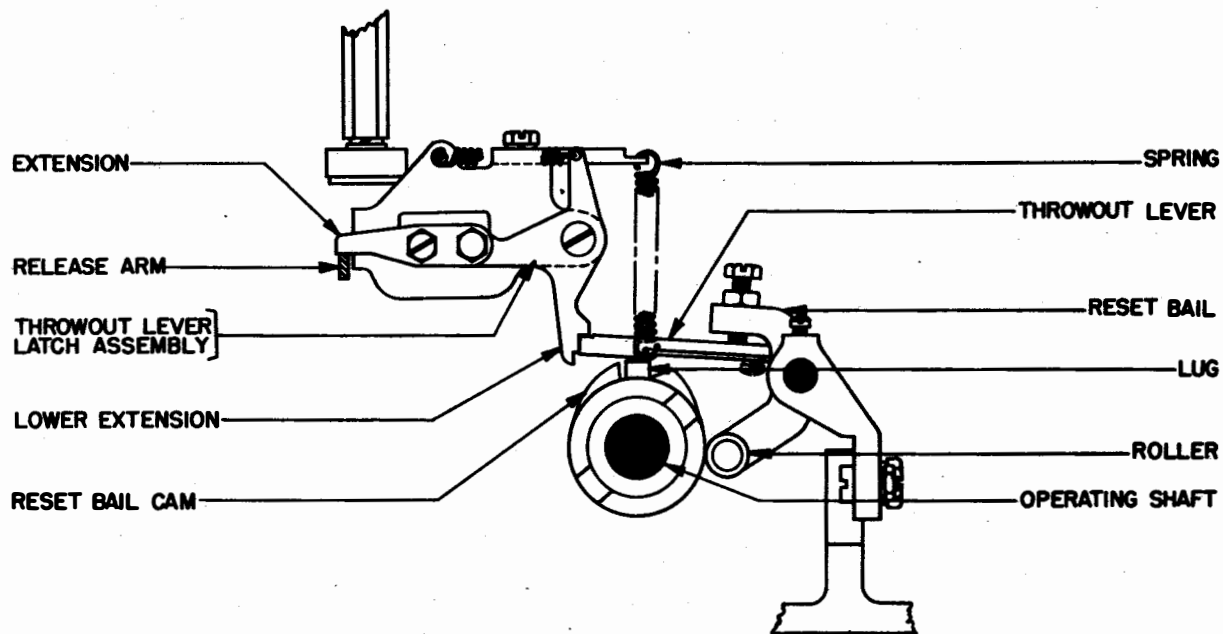
FRONT VIEW
FIGURE 18



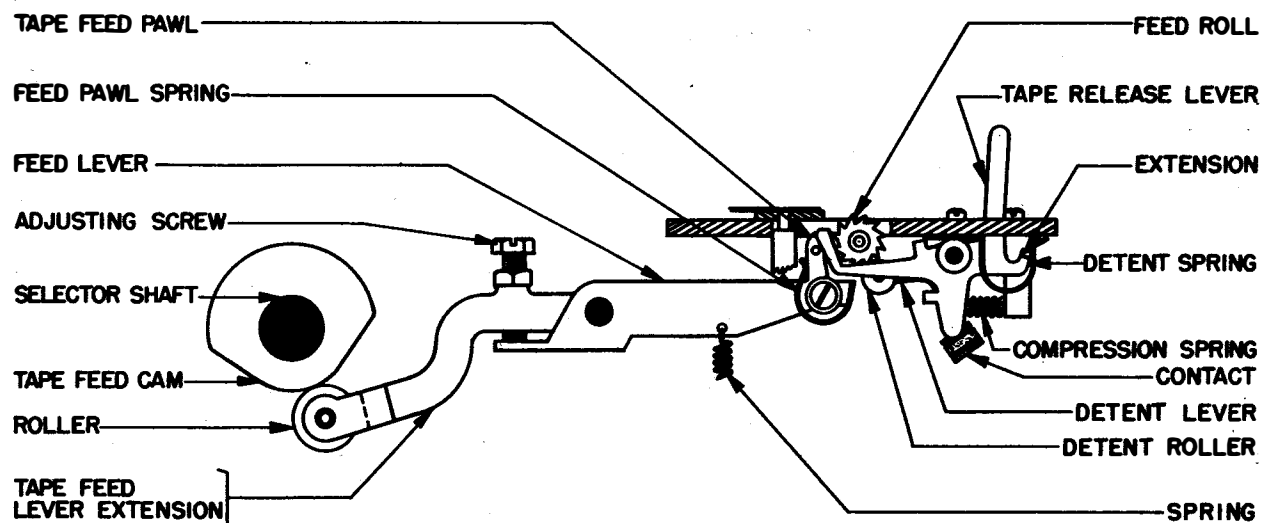
FRONT VIEW
FIGURE 19



RIGHT SIDE VIEW
FIGURE 20



RIGHT SIDE VIEW
FIGURE 21



FRONT VIEW
FIGURE 22

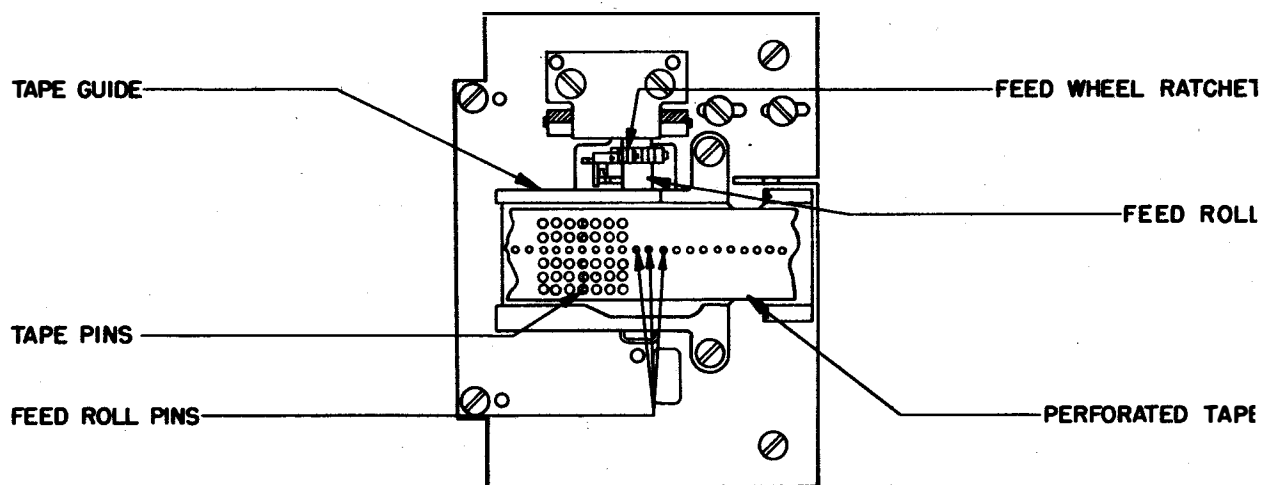
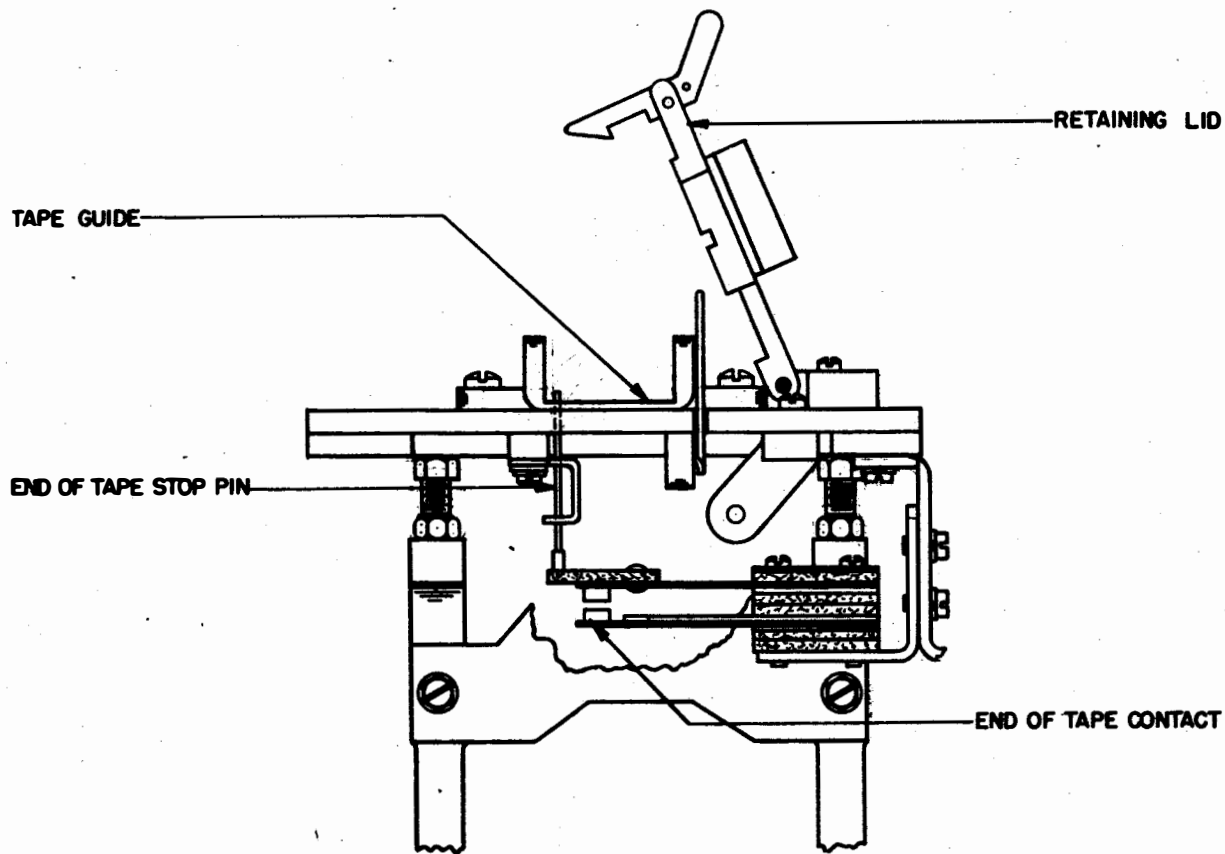
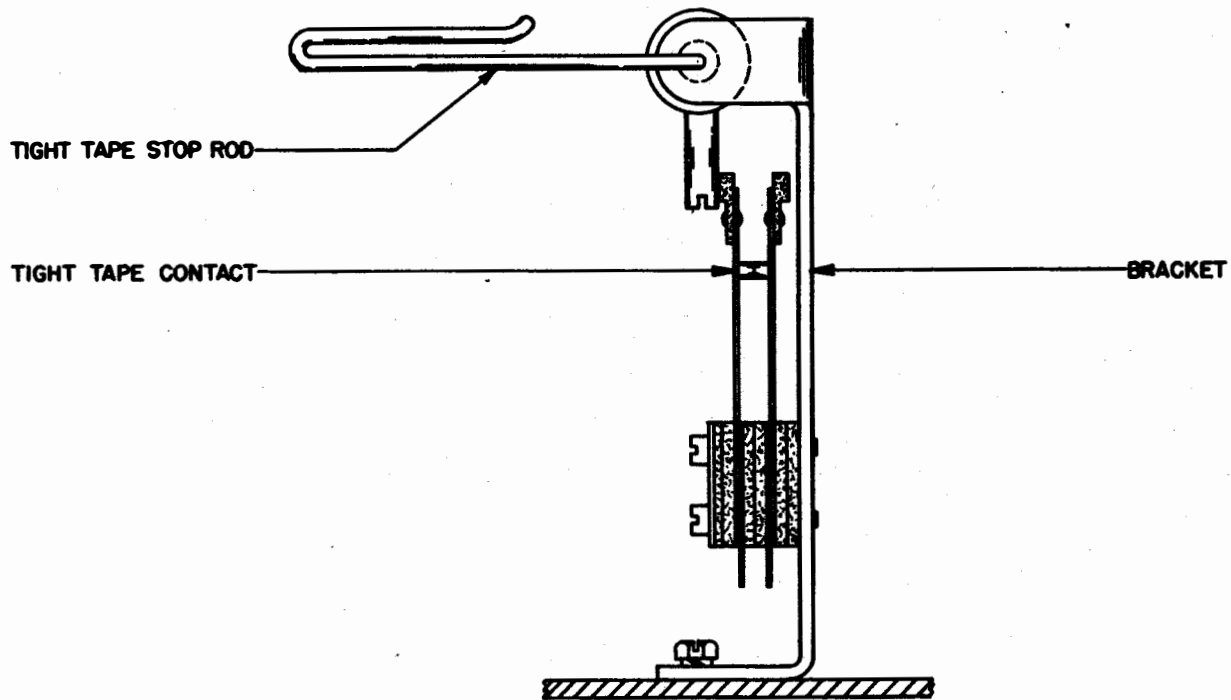


FIGURE 23



RIGHT SIDE VIEW
FIGURE 24



RIGHT SIDE VIEW
FIGURE 25